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Science | Sciences
Newfoundland and Labrador Region
Canadian Science Advisory Secretariat
Science Advisory Report 2011/003

ASSESSMENT OF DIVISIONS 2G-3K NORTHERN SHRIMP

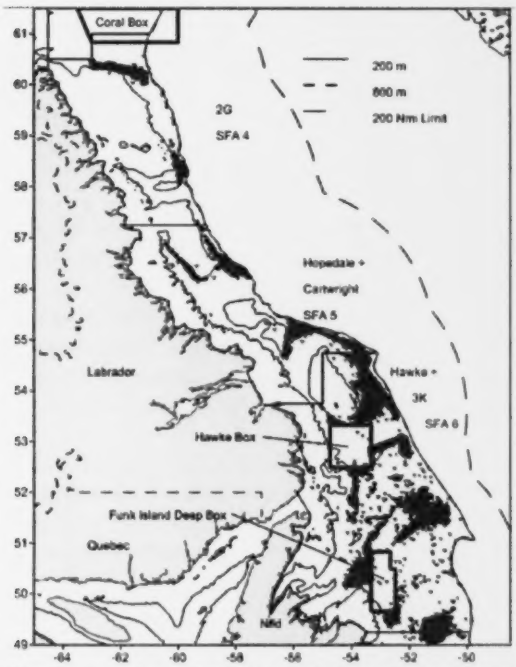

Figure 1. Map of northern shrimp fishing areas (SFAs) including the Coral, Hawke Channel and Funk Island Deep closed areas. The red crosses indicate large and small vessel fishing positions during 2010.

Context

The bottom trawl fishery for Northern Shrimp off the coast of Labrador began in the mid 1970s, primarily in the Hopedale and Cartwright channels, Shrimp Fishing Area (SFA) 5, expanding north to SFA 4 and south to SFA 6 through the 1980s. Overall Total Allowable Catch (TAC) increased from 23,000 t in 1994 to 112,000 t in 2003. The management year for shrimp fishing areas 4-6 changed from a calendar year to April 1–March 31 in 2003. An interim quota of 20,229 t was set for Jan 1–Mar. 31, 2004. Thus the 2003/04 management year was 15 months in length and the total TAC within SFAs 4-6 was set at 132,000 t. Between 2003/04 and 2007/08 TACs remained at 112,000 t then increased to 120,000 t in 2008/09 remaining at that level in 2009/10 after which the TAC decreased to 96,000 t in 2010/11 due to resource status concerns within SFA 6. The TACs were taken during most years.

DFO Fisheries and Aquaculture Management has requested science advice on the status of northern shrimp in SFAs 4, 5 and 6. This resource was last assessed during March 2010 and is normally assessed on a biennial basis, however, due to declines in the SFA 6 portion of the resource, a request was made for a full assessment in 2011.

A formal assessment of the resource was conducted during February 15–25, 2011. The assessment made use of fishery data from observer and logbook datasets when estimating catch rate indices and indices of fishery aggregation. Bottom trawl surveys provided indices of recruitment, female spawning stock biomass (SSB), fishable biomass and exploitation rate.

This report provides a summary of key results of the assessment, a narrative describing the fishery with an expanded discussion of resource status and outlook.

Canada

SUMMARY

- The thermal regime has been warming over the past decade. Effects of a warm regime on shrimp distribution and behaviour are unknown. However, a warm surface regime is believed, from the literature, to be detrimental to shrimp early survival and subsequent recruitment.

- Shrimp and Capelin are key forage species in NAFO Divisions 2J3KL (SFAs 5, 6 and 7). Capelin abundance is at very low levels while some groundfish are increasing. Together this may increase predation pressure on shrimp.

- Resource status was updated based on a DFO fall multi-species research vessel (RV) bottom trawl survey series (1996-2010), which provided information on shrimp distribution, abundance, biomass, recruitment, size, and sex composition in the Div. 2J portion of SFA 5 and Hawke Channel + Div. 3K (SFA 6). Trends in stock size were also inferred from fishery catch per unit effort (CPUE) and fishing patterns.

- The Northern Shrimp Research Foundation (NSRF) in partnership with DFO conducted annual shrimp based research surveys in Division 2G (SFA 4) during 2005-2010.

- The resource has been decreasing in the south (SFA 6) and remained at 2009 levels in the north (SFA 4 and 5).

SFA 6 (Hawke Channel and NAFO Division 3K)

- Catch decreased from a peak level in 2007/08 of 81,000 t to the 2010/11 TAC of 61,632 t. The TAC was reduced for 2010/11 under the IFMP PA framework.

- The large vessel CPUE increased significantly between 1992 and 1997 and remained reasonably constant until 2006. Thereafter it declined significantly until 2009 with an increase in 2010. The 2010 CPUE was close to the mean of the series. The small vessel CPUE showed a similar pattern, but there are some concerns regarding the effort data, derived from logbooks.

- Fishable biomass in the fall RV survey increased significantly from 2003 to nearly 670,000 t in 2006 and then declined to about 300,000 t by 2010. This decrease is significant. Female spawning stock biomass showed a similar pattern declining from 460,000 t in 2006 to 190,000 t in 2010.

- The recruitment indices reached a peak in 2006 and then continuously declined to near the lowest level in the time series.

- Total mortality from age 3+ in one year to age 4+ in the following year, from the RV survey data, increased from 23% to 41% over the period 2004 to 2010.

- Under the current TAC, the exploitation rate in 2010/11 would be 20% by March 31, 2011, the highest in the time series.

- Female spawning stock biomass (SSB) was assessed to be in the Cautious Zone of the IFMP PA framework for the second consecutive year and there is a declining trend. The 2010/11 exploitation rate is expected to be about 20%.

SFA 5 (Hopedale and Cartwright Channels)

- Catches increased from 15,000 t in 1997–2002 to around 23,000 t and remained at about that level until the present.
- In recent years CPUE has been above the long term mean with little change.
- Female spawning stock biomass and fishable biomass indices increased after 1999 and has since remained at or above the mean.
- The recruitment index has remained near the mean since 2003.
- Exploitation rate has varied without trend between 15-20% over the time series.
- Female spawning stock biomass was assessed to be in the Healthy Zone of the IFMP PA Framework. The exploitation rate for 2009/10 was estimated to be 19%, above the base target exploitation rate of 15% for the Healthy Zone. However flexibility is allowed in this zone and this level of exploitation is not a concern.

SFA 4 (NAFO Division 2G)

- Catches increased from 4,000 t in 1994 to 10,000 t in 2004/05 and remained at about that level until the present.
- CPUE has increased since 2008/09 and is now above the long-term mean. This may be partially due to changes in fishing pattern.
- There was no strong evidence of change in either female spawning stock biomass or fishable biomass indices over the period 2007–2010. The current survey female spawning stock biomass is 70,000 t while the fishable biomass is 127,000 t.
- The recruitment index was roughly twice as high in the 2008–2010 period as it was in the previous three years.
- Over the period 2006–2010, the exploitation rate has been about 9%.
- Female spawning stock biomass was assessed to be in the Healthy Zone of the IFMP PA framework. The exploitation rate is below the base target exploitation rate of 15% for the Healthy Zone.

BACKGROUND

Species Biology

Northern or Pink Shrimp (*Pandalus borealis*) are found in the Northwest Atlantic from Davis Strait to the Gulf of Maine, usually in areas where the ocean floor is soft and muddy and where

temperatures near the bottom range from about 1°C to 6°C. These conditions occur throughout the Newfoundland and Labrador offshore area within a depth range of roughly 150-600 m, thus providing a vast area of suitable habitat. The species is the primary cold-water shrimp resource in the North Atlantic.

These shrimp are protandrous hermaphrodites. They first mature as males, mate as males for one to several years and then change sex to spend the rest of their lives as mature females. They are known to live for more than eight years in some areas. Some northern populations exhibit slower rates of growth and maturation but greater longevity results in larger maximum size. Most of the fishable biomass is female.

The shrimp are thought to begin to recruit to the fishery at age three, but may not be fully recruited until much later.

During the daytime, northern shrimp rest and feed on or near the ocean floor. At night, substantial numbers migrate vertically into the water column, feeding on zooplankton. They are important prey for many species such as Atlantic Cod, Greenland Halibut, skates, wolffish, Snow Crab and Harp Seals.

Fishery

The fishery for Northern Shrimp off the coast of Labrador began in the mid 1970s, primarily in the Hopedale and Cartwright (SFA 5) channels (Fig. 1). Annual catches (Fig. 2) increased steadily from less than 2700 t in 1977 to about 4100 t in 1981 but subsequently declined to 1000 t in 1983 and 1984 due to poor markets and high operating costs. Economic conditions improved thereafter, and catches from SFA 5 and 6 increased to about 7800 t in 1987. In 1988, fishing effort became more widespread as vessels ventured into Division 2G (SFA 4) where both catch rate and size of shrimp proved to be very attractive to the industry. Additional commercial concentrations of shrimp were located within SFA 6 in a small area east of St. Anthony Basin and in the Funk Island Deep. Catches in both 1988 and 1989 approached 17,000 t and remained in the 14,000-20,000 t range from 1990 to 1993. Exploratory fisheries along the slope of the shelf in SFAs 4, 5 and 6 in 1992 and 1993 revealed commercial concentrations of shrimp in those areas, as well.

Catches from 1994 to 1996 averaged 23,000 t increasing to 85,000 t by 2000, following increases in TAC within SFA 6 where the resource was considered to be healthy and exploitation low. The increases after 1996 were primarily reserved for the development of a small vessel (< 100 ft) fleet which has since grown to include more than 300 vessels.

The overall TAC increased by 25,000 t in 2003. During that year industry was granted a change in management year from calendar (Jan. 1 – Dec. 31) to fiscal (Apr. 1 – Mar. 31). To facilitate this change, an additional 20,229 t interim quota was allocated to the large vessel fleet and the 2003/04 management period became 15 months in length. The 2004/05 management year was 12 months in duration and total allocations equaled 111,552 t. This TAC was maintained until 2008/09 when it was increased to 120,344 t. This TAC was maintained through to 2009/10; however, due to operational and commercial constraints, it was not taken. Under the Integrated Fisheries Management Plan (IFMP, http://www.dfo-mpo.gc.ca/fm-gp/peches-fisheries/ifmp-gmp/shrimp-crevette/shrimp-crevette-2007-eng.htm) Precautionary Approach (PA) framework, the SFA 6 TAC was decreased by 28% to 61,632 t resulting in an overall TAC of 96,252 t for the 2010/11 management year. It was anticipated that this TAC will be taken by March 31, 2011.

During 2007 a seasonal bridging program was established that allows each license holder to fish up to 250 t of unused quota from the previous year or take it from the next year's quota.

All Northern Shrimp fisheries in eastern Canada are subject to the Atlantic Fisheries Regulations regarding territorial waters, by-catches, discarding, vessel logs, etc. These include a minimum mesh size of 40 mm and mandatory use of sorting grates to minimize by-catch of non-target species. Grate size is dependent upon area fished and vessel class. Observers are required on all trips by the large vessel fleet and a target of 10% coverage has been established for the small vessel fleet.

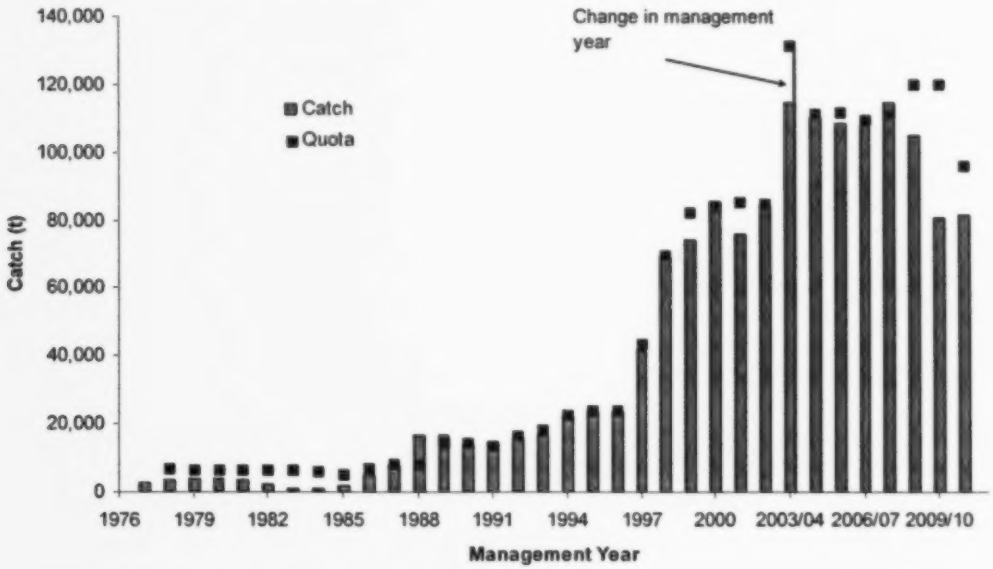

Figure 2. Historical Northern Shrimp catches (SFAs 4-6) and TACs for the period 1977-2011 (2010/11 catches are preliminary). In 2003, the management year changed to a fiscal year.

ASSESSMENT

Resource status was evaluated based on trends in fishery Catch Per Unit Effort (CPUE) derived from logbooks and observer datasets, indices from DFO autumn multi-species bottom trawl surveys in Divisions 2HJ3K, a joint Northern Shrimp Research Foundation (NSRF)-DFO summer shrimp-based survey in Division 2G, as well as biological sampling from multiple sources.

The bottom trawl surveys provide indices of recruitment, total abundance, SSB, fishable biomass, and total biomass. Recruitment indices include the abundance of males and females with 11.5 - 17 mm carapace lengths and the abundance of age 2 animals based on modal analysis. The fishable biomass is defined as the weight of all males and females with a carapace length > 17 mm. Exploitation rate index was determined by comparing the catch to the survey fishable biomass index (catch/previous year autumn fishable biomass index for SFA 5 and 6; catch/current year summer fishable biomass index for SFA 4). Total mortality was based on the RV survey abundance of age 4+ in year t + 1 divided by abundance of age 3+ in year t, averaged over four years. The spatial index, an index of aggregation, was based on percent area fished relative to total area of the SFA required to obtain 95% of the catch.

The Precautionary Approach (PA) framework was applied using an Upper Stock Reference (USR = 80% of the geometric mean of SSB over a productive period) and a Limit Reference Point (LRP = 30% of the geometric mean of SSB over a productive period) superimposed upon the exploitation rate trajectory over time. Due to differences in survey history, the respective productive time periods were thought to be 1996 – 2003 for SFA 6, 1996 – 2001 for SFA 5 and 2005 – 2009 for SFA 4.

SFA 6 (Hawke Channel and NAFO Division 3K)

Commercial Fishery:

The TAC was set at 11,050 t in 1994 and increased to 23,125 t in 1997 (Fig. 3) as a first step towards increasing the exploitation of an abundant resource. Most of the increase was reserved for development of the small vessel fleet. The TAC more than doubled between 1997 and 1999, increased to 61,632 t in 2002 and then to 77,932 t in 2003. An additional interim quota of 7653 t was set for the fishing season January 1 – March 31, 2004 to facilitate an industry requested change in fishing season from April 1 – March 31. Thus the 2003/04 management period was 15 months long and had an 85,585 t TAC. The 2004/05 management year was 12 months and had a 77,932 t TAC. As a result of the seasonal bridging program, the 77,932 t TAC for 2007/08 was exceeded by 2000 t. The TAC was increased to 85,725 t in 2008/09 and maintained through 2009/10. Due to operational factors/market conditions, the TAC was not taken during either of these years. Under the IFMP PA framework, the 2010/11 TAC was reduced to 61,632 t and it is anticipated that the TAC will be taken.

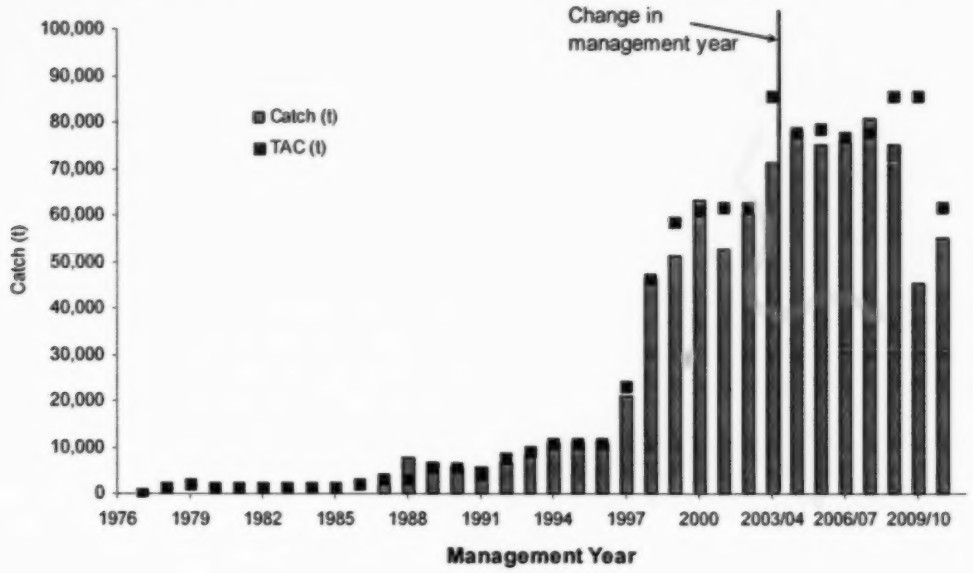

Figure 3. Historical Northern Shrimp catches (SFA 6) and TACs for the period 1977-2011 (2010/11 catches are preliminary). In 2003, the management year changed to a fiscal year.

The large vessel CPUE increased significantly between 1992 and 1997 and remained reasonably constant until 2006. Thereafter it declined significantly until 2009 with an increase in 2010. The 2010 CPUE was close to the mean of the series. The small vessel CPUE showed a

similar pattern; however, the interpretation of the effort data from the logbooks may be skewing the CPUE on the low side (Fig. 4). Further analysis is planned during 2011 to clarify this concern.

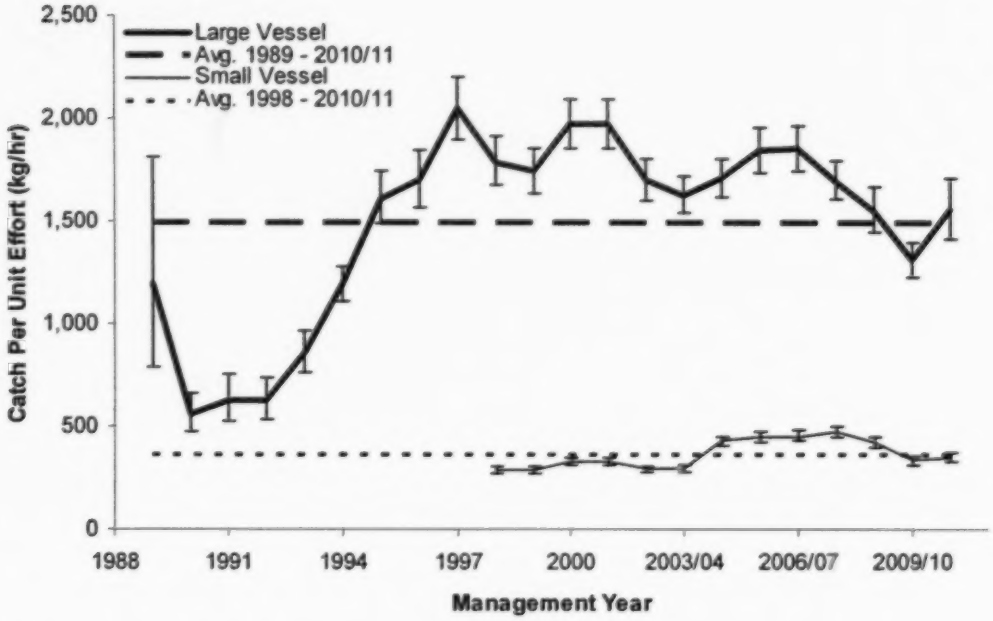

Figure 4. SFA 6 large and small vessel CPUE (error bars indicate 95% confidence intervals).

The spatial distribution of the resource and large vessel fishery changed little over recent years. The spatial distribution of the small vessel fishery increased from 1998 to 2007 then decreased to 2009, remaining near that level in 2010 (Fig. 5).

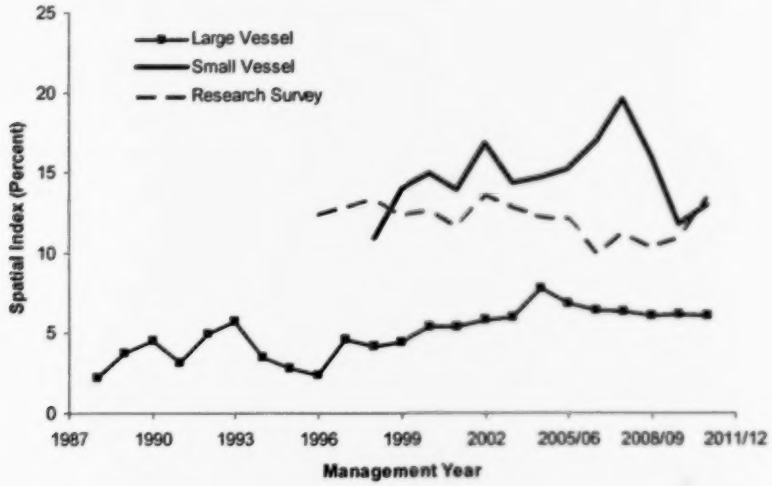

Figure 5. SFA 6 Spatial Index for research survey and commercial catches over the period 1989–2010. The commercial fishery indices were based upon April 1 – March 31 data after 2002 while the survey index is based upon a calendar year.

Biomass

Fishable biomass in the fall RV survey increased significantly from 2003 to nearly 670,000 t in 2006 and then declined to about 300,000 t by 2010. This decrease is significant. Female spawning stock biomass showed a similar pattern declining from 460,000 t in 2006 to 190,000 t in 2010 (Fig. 6).

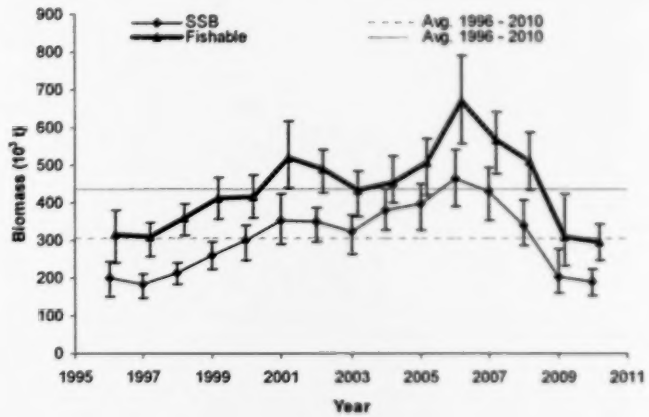

Figure 6. SFA 6 biomass indices (error bars indicate 95% confidence intervals).

Recruitment

The recruitment indices reached a peak in 2006 and then continuously declined to near the lowest level in the time series (Fig. 7). There is no clear relationship between recruitment

indices and fishable biomass. The apparently strong 2004 year class (age 2 in 2006) did not lead to increased fishable biomass.

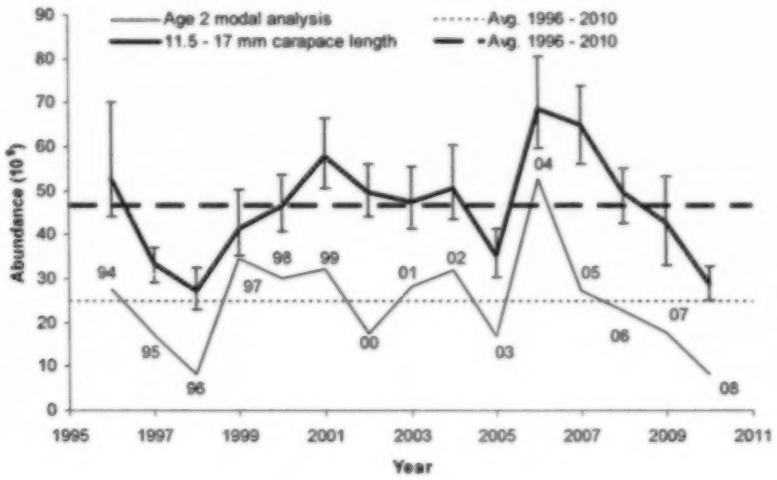

Figure 7. SFA 6 recruitment indices (error bars indicate 95% confidence intervals). Numbers denote year classes derived from modal analysis.

Mortality

Total mortality based on the RV survey abundance of age 4+ in year t + 1 divided by abundance of age 3+ in year t, averaged over four years, increased from 23% to 41% over the period 2004 to 2010 (Fig. 8).

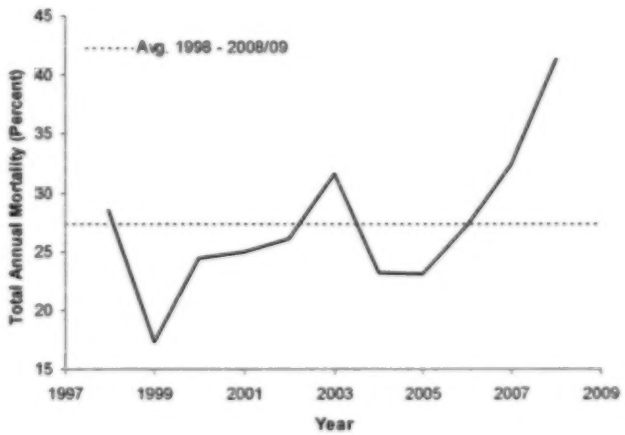

Figure 8. Total mortality index based on the RV survey abundance of age 4+ in year t + 1 divided by abundance of age 3+ in year t, averaged over four years. Year is the midpoint of the four year period.

Under the current TAC, the exploitation rate in 2010/11 would be 20% by March 31, 2011, the highest in the time series (Fig. 9).

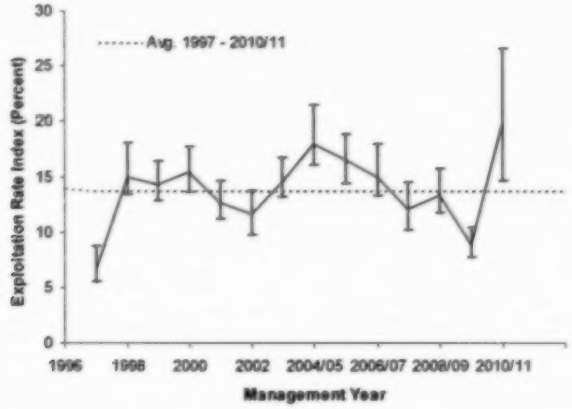

Figure 9. SFA 6 exploitation rate index based on the total catch/fishable biomass index from the previous year, expressed as a percentage. Error bars indicate 95% confidence intervals. The 2010/11 fishery was ongoing therefore the catch was prorated to the TAC.

Female spawning stock biomass was assessed to be in the Cautious Zone of the IFMP PA framework for the second consecutive year and there is a declining trend. If the 2010/11 TAC is taken, the exploitation rate will be about 20% (Fig. 10). The SSB decreased slightly to 190,200 t in 2010. If the current TAC is maintained in 2011/12, the exploitation rate will be about 21%.

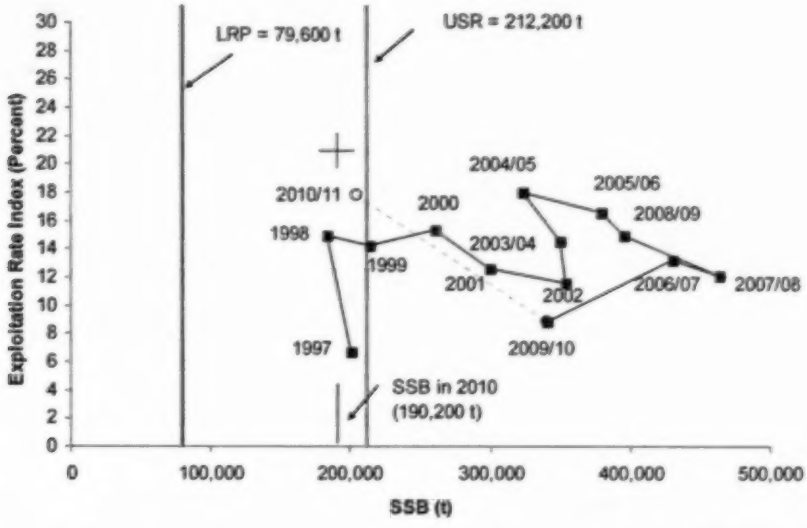

Figure 10. SFA 6 Precautionary Approach framework with trajectory of exploitation rate index vs SSB. Numbers denote management year. The exploitation rate index for 2010/11 was as of February 2, 2011 (open circle). Crosshairs mark the exploitation rate index if the status quo TAC is maintained for 2011/12 and taken.

SFA 5 (Hopedale and Cartwright Channels)

Commercial Fishery

The TAC doubled from 7650 t during 1994 - 1996 to 15,300 t over the 1997-2002 period. In 2003, the TAC increased to 23,300 t, the management year changed to April 1 – March 31, and an additional interim quota of 9,787 t was set for the period January 1 – March 31, 2004. Thus the 2003/04 management period was 15 months long and had a 33,087 t TAC. The 2003/04 management year TAC (23,300 t) was maintained through to 2010/11. The TAC has been taken in most years. As a result of the seasonal bridging program, the 23,300 t TAC for 2009/10 was allowed to be exceeded by 2000 t. Approximately 15,000 t were taken by February 2, 2011 and it is anticipated that the remainder of the TAC will be taken (Fig. 11).

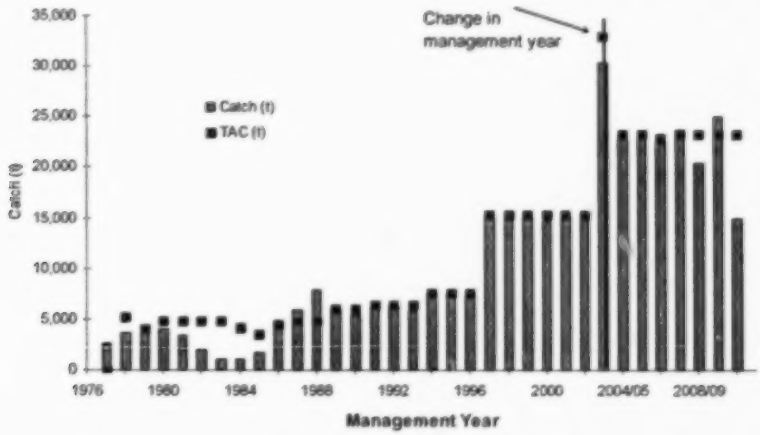

Figure 11. SFA 5 historical Northern Shrimp catches and TACs for the period 1977-2010 (2010/11 catches are preliminary). In 2003, the management year changed to a fiscal year.

In recent years CPUE has been above the long term mean with little change (Fig. 12).

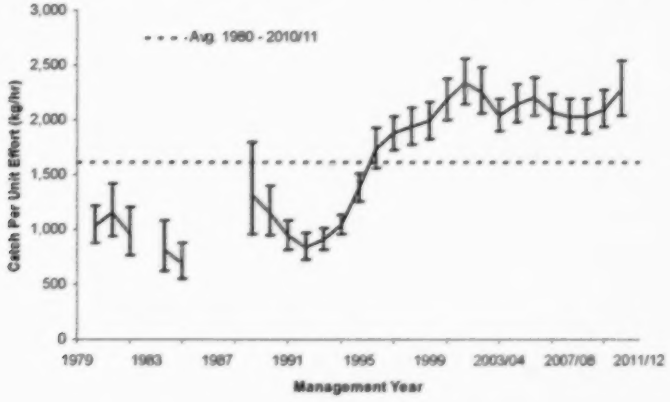

Figure 12. SFA 5 large vessel CPUE (error bars indicate 95% confidence intervals).

The spatial index for the large vessel (>500 t) catch increased from 5–11% over the period 1985–2010 (Fig. 13). The spatial index has increased over a long period during which CPUE

was maintained above the long term mean which is an indication of a healthy resource with a broad distribution.

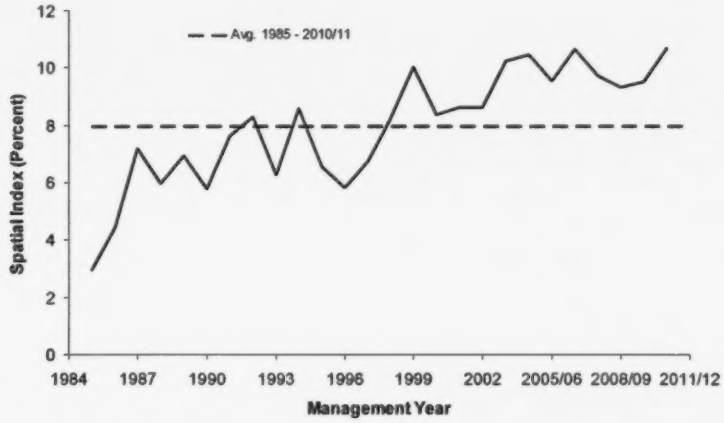

Figure 13. SFA 5 spatial index for large vessel catches over the period 1985–2010.

Biomass

Annual autumn multi-species surveys were conducted in the northern part of SFA 5 (NAFO Division 2H) between 1996 and 1999. Since then, surveys of the whole of SFA 5 were completed in only five (2001, 2004, 2006, 2008 and 2010) of the last eleven years. However, the southern portion of SFA 5 (Cartwright Channel) has been surveyed during all years since 1996. In the years that all of SFA 5 has been surveyed, trends in indices and biological characteristics for the entire area and the Cartwright Channel portion were broadly consistent (Fig. 14).

SSB and fishable biomass indices increased after 1999 and have since remained at or above the mean (Figs 14 and 15).

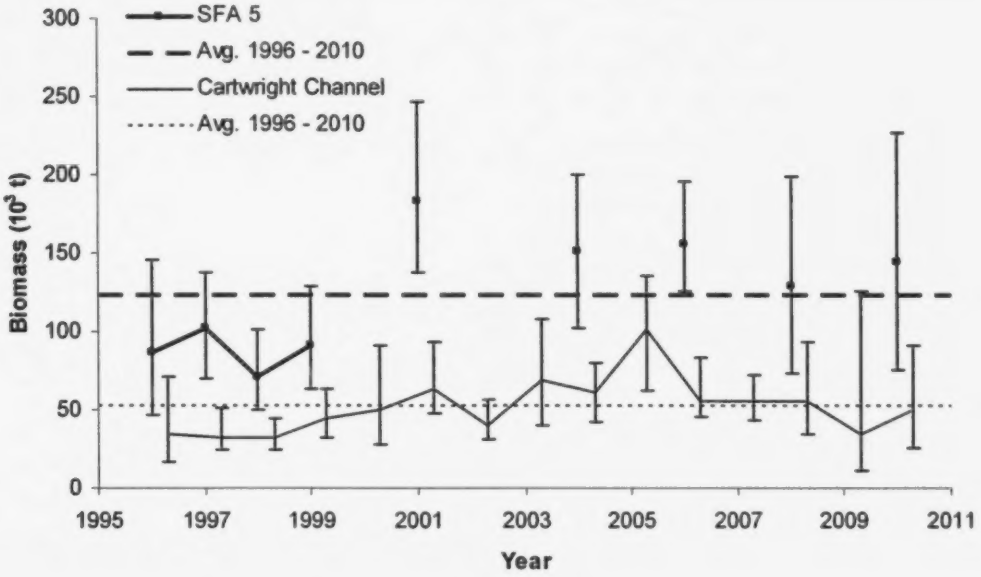

Figure 14. SFA 5: fishable biomass index within the entire of SFA 5 and Cartwright Channel (error bars indicate 95% confidence intervals).

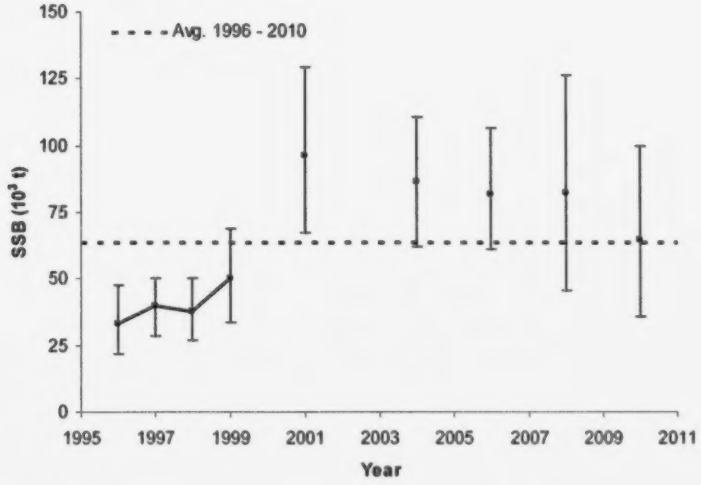

Figure 15. SFA 5 SSB index (error bars indicate 95% confidence intervals).

Recruitment

The recruitment index has remained near the mean since 2003 (Fig 16).

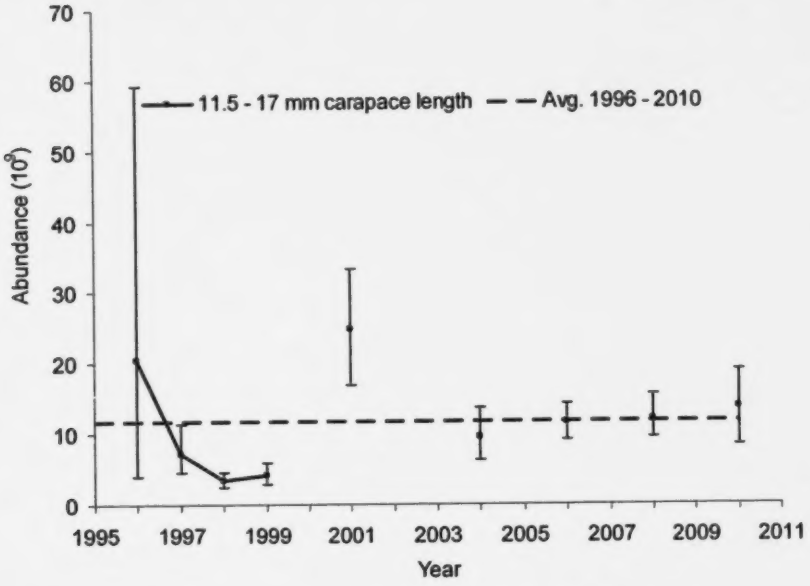

Figure 16. SFA 5 recruitment index (error bars indicate 95% confidence intervals).

Mortality

Exploitation rate has varied without trend between 15-20% over the time series (Fig. 17).

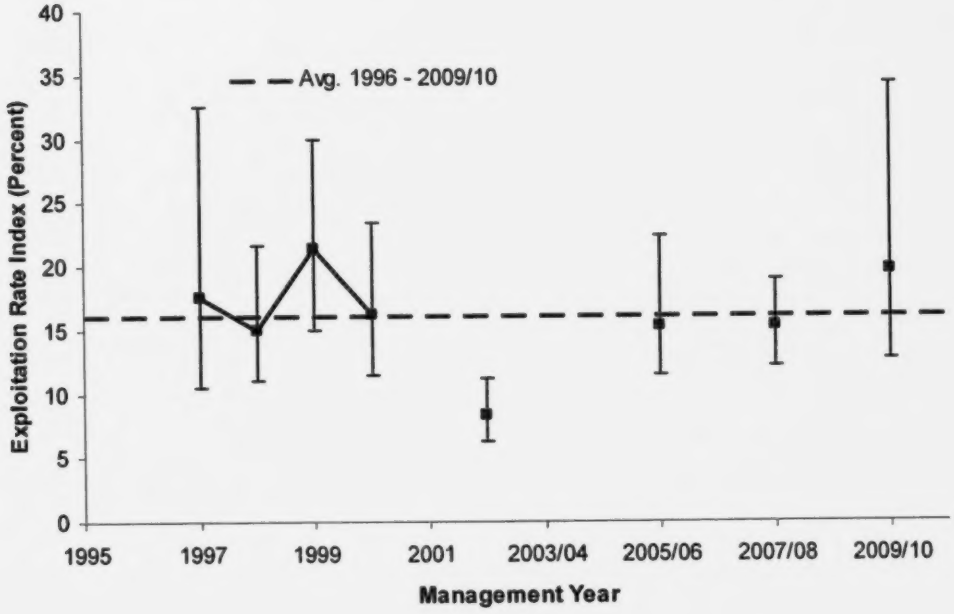

Figure 17. SFA 5 exploitation rate index over the period 1996–2009 (error bars indicate 95% confidence intervals).

SSB was assessed to be in the Healthy Zone of the IFMP PA Framework (Fig. 18). The exploitation rate for 2009/10 was estimated to be 19%, above the base target exploitation rate of 15% for the Healthy Zone. However flexibility is allowed in this zone and this level of exploitation is not a concern.

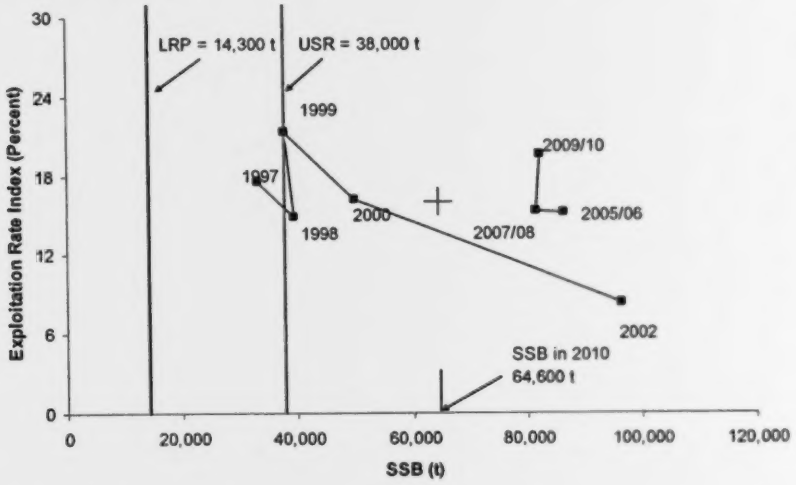

Figure 18. SFA 5 Precautionary Approach framework with trajectory of exploitation rate index vs SSB. Numbers denote management year. Crosshairs mark the exploitation rate index if the status quo TAC is maintained for 2011/12 and taken.

SFA 4 (NAFO Division 2G)

Commercial Fishery

The TAC increased from 2580 t in 1989 to 5200 t in 1995 and 8320 t in 1998 (Fig. 19). In 1998, 2184 t of the TAC was allocated to the area south of 60°N to promote spatial expansion of the fishery. The 2003 TAC was increased to 10,320 t. In 2003 the management year changed to April 1 – March 31, and an additional interim quota of 2802 t was set for the period January 1 – March 31, 2004. Thus the 2003/04 management period was 15 months and had a 13,122 t TAC. The 10,320 t TAC was maintained through to 2007/08. The TAC was increased to 11,320 t in 2008/09 and maintained at that level up to and including 2010/11. By 2009/10, the regulations were changed such that the vessels no longer had to fish a portion of their catch in southern SFA 4. Preliminary data indicate that approximately 11,000 t were taken during the 2010/11 management year.

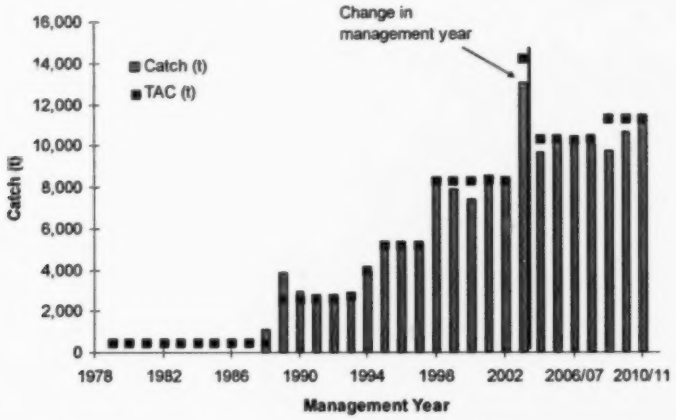

Figure 19. SFA 4 historical Northern Shrimp catches and TAC for the period 1979-2010 (2010/11 catches are preliminary). In 2003, the management year changed to a fiscal year.

CPUE has increased since 2008/09 and is now above the long-term average (Fig. 20). This may be partially due to changes in fishing pattern resulting from removal of regulations forcing the fleet to take a portion of their catch in southern SFA 4.

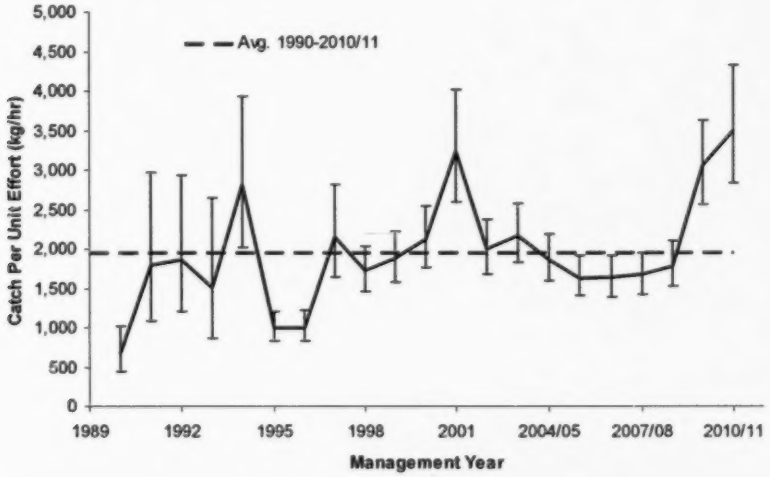

Figure 20. SFA 4 large vessel CPUE (error bars indicate 95% confidence intervals).

The spatial index for the large vessel (>500 t) fleet has changed little since 1998 (Fig. 21).

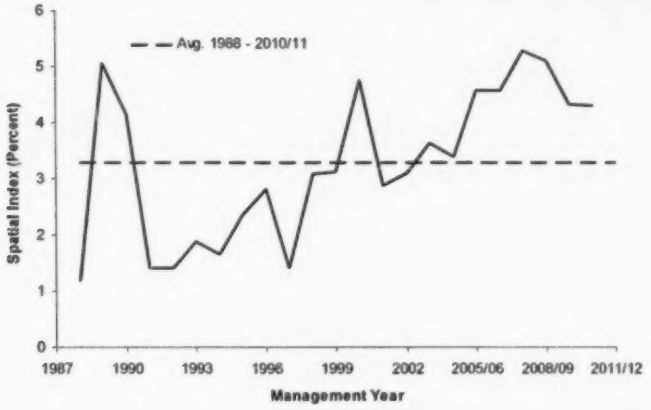

Figure 21. SFA 4 spatial index for large vessel catches over the period 1988–2010/11.

Biomass

There was no strong evidence of change in either SSB or fishable biomass indices over the period 2007–2010. The current SSB index is 70,000 t while the fishable biomass index is 127,000 t (Fig. 22).

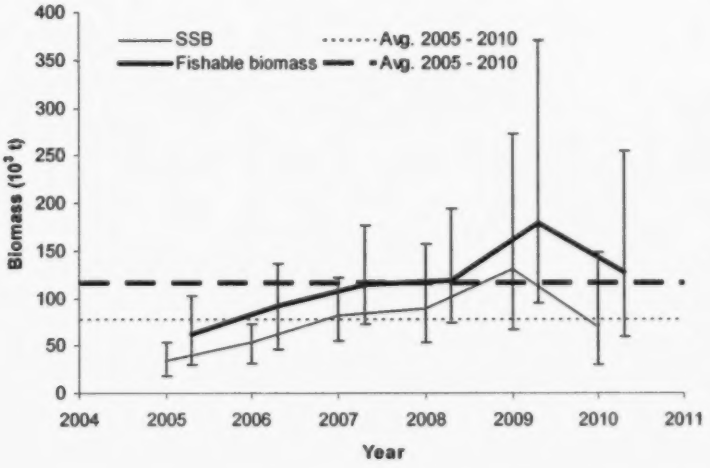

Figure 22. SFA 4 biomass indices (error bars indicate 95% confidence intervals).

Recruitment

The recruitment index was roughly twice as high in the 2008–2010 period as it was in the previous three years (Fig. 23).

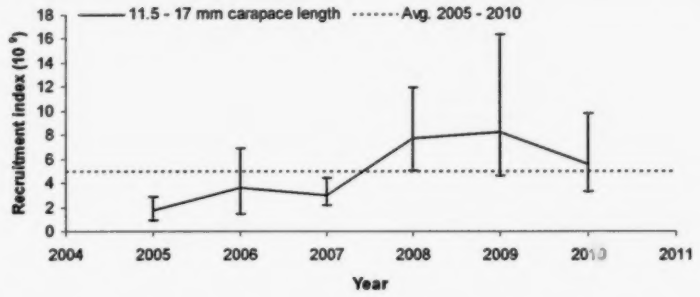

Figure 23. SFA 4 recruitment index (error bars indicate 95% confidence intervals).

Mortality

Over the period 2006–2010, the exploitation rate has been about 9% (Fig. 24).

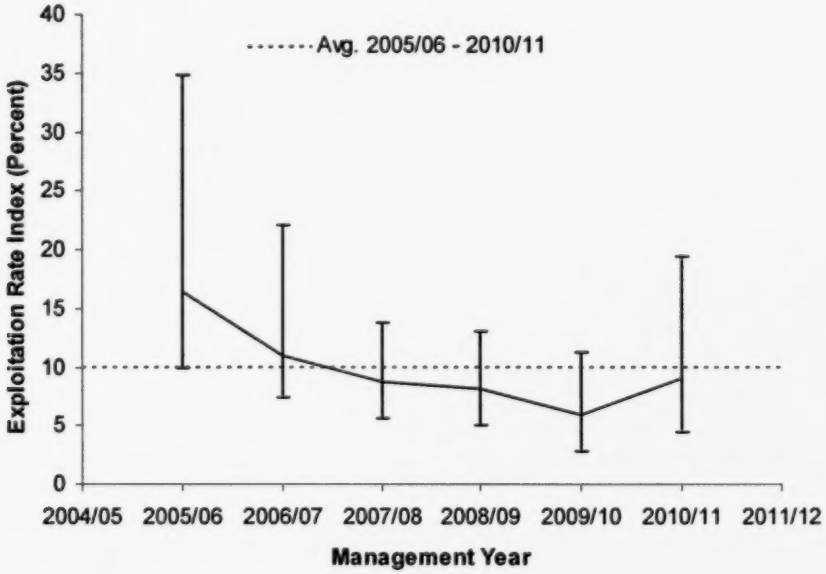

Figure 24. SFA 4 exploitation rate index. (total catch/fishable biomass index from the same year; error bars indicate 95% confidence intervals).

Spawning stock biomass is currently assessed to be in the Healthy Zone under the IFMP PA Framework. The current exploitation rate is below the base target exploitation rate of 15% for the Healthy Zone (Fig 25).

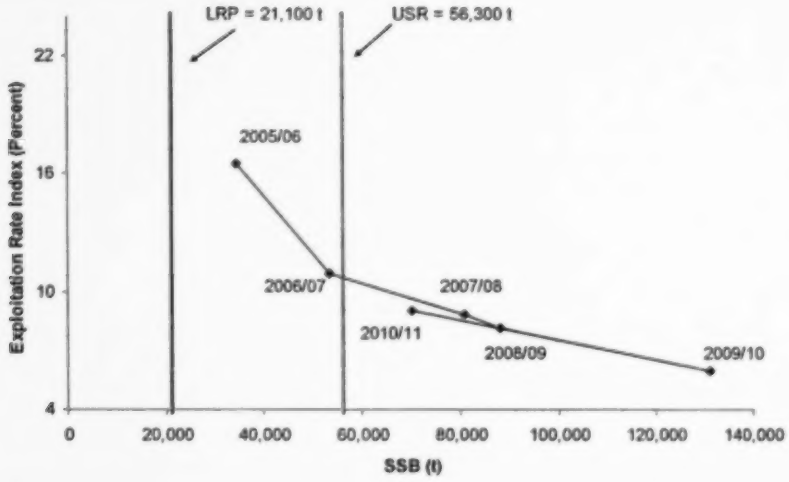

Figure 25. SFA 4 precautionary approach framework with trajectory of exploitation rate index vs SSB.

Industry Perspectives:

Small vessel shrimp fleet perspective

In 2010, harvesters continued to observe changes in shrimp behavior due to increased interactions with predators such as cod and turbot. As cod and turbot populations increase they are thought to be frequently displacing shrimp from the bottom at certain times, thus making them inaccessible to fishing gear.

Harvesters saw an increased frequency of high northerly and easterly winds in 2010. These conditions historically contribute to lower catch rates. Harvesters also believe these same persistent conditions likely affected the catch rates from the fall RV survey.

Large vessel shrimp fleet perspective:

There were no significant changes observed in the large vessel commercial shrimp fishery in SFA 2, SFA 4 and SFA 5. In SFA 6, the decline in abundance observed in 2009 seemed to have leveled off in 2010. However, catch rates were much more variable through 2010 than would normally be the case, possibly due to some combination of wind direction changes, water temperature fluctuations and fewer than normal concentrations of shrimp. Commercial catch rates are negatively affected by easterly winds that were much more prevalent through 2010 than normal, including in the late fall and early winter. It is likely that research vessel catch rates (e.g. during the fall 2010 survey) would have been similarly affected.

Sources of Uncertainty

The implications of finishing some autumn multi-species surveys later than usual are unknown.

Spatio-temporal variation among three DFO research vessels particularly in NAFO Division 3K (SFA 6) is a source of uncertainty and the implications are unknown.

SFA 5 is surveyed in its entirety biennially (NAFO Div. 2J annually, 2H biennially).

The shortness of the survey time series, lack of dynamic range and stock-recruit relationships limits modeling stock dynamics. There is no risk analysis for this resource. There is uncertainty in the appropriateness of the current reference points.

Area closures may bias commercial catch rate models as indicators of resource status.

Physical and biological changes in the ecosystem may affect the availability of shrimp to commercial and survey trawls.

CONCLUSIONS AND ADVICE

The resource has been decreasing in the south (SFA 6) and remained at 2009 levels in the north (SFA 4 and 5).

SFA 6

There is concern for the current status. Biomass indices from fall multi-species surveys generally increased from 1997 to peak levels in 2006 but have since decreased by approximately 60%. SSB is in the Cautious Zone of the IFMP PA framework for the second consecutive year and there is a declining trend. SSB is at 90% of the Upper Stock Reference point. Total mortality increased from 23% to 41% over the period 2004 to 2010.

The present catch levels may not be sustainable given the declining biomass. If the current TAC is taken in 2011/12, the exploitation rate index would be about 21%.

SFA 5

Current status remains positive. Since 2001, biomass indices have remained at or above the long-term average. SSB is in the Healthy Zone of the IFMP PA framework.

If the current TAC is taken in 2011/12, the exploitation rate index would be about 16% and is near the base target exploitation rate of 15% for the Healthy Zone.

SFA 4

Current status remains positive. Biomass indices have changed little since 2006. SSB is in the Healthy Zone of the IFMP PA framework, well above the USR. The exploitation rate has been about 9% since 2005 well below the base target exploitation rate of 15% for the Healthy Zone.

MANAGEMENT CONSIDERATIONS

Exploitation strategies for this resource should take into consideration the importance of shrimp as a forage species. Shrimp and capelin are key forage species in NAFO Divisions 2J3KL

(SFAs 5, 6 and 7). Capelin abundance is at very low levels while some groundfish are increasing. Together this may increase predation pressure on shrimp.

The current IFMP recognizes that management of key forage species under an ecosystem approach requires adoption of a more conservative approach than what would otherwise be adopted under a single species management approach. There is consensus that there is need for better understanding of ecosystem demands on shrimp as a forage species and to incorporate this improved understanding into shrimp harvesting strategies on a go forward basis. In this context there is a need for focused research on how these linkages should be reflected in the setting of reference points.

SOURCES OF INFORMATION

This Science Advisory Report has resulted from a Fisheries and Oceans Canada, Canadian Science Advisory Secretariat zonal advisory process held 15-25 February 2011 on the assessment of northern and striped shrimp in Shrimp Fishing Areas (SFAs) 2-6. Additional publications from this process will be posted as they become available on the DFO Science Advisory Schedule at http://www.dfo-mpo.gc.ca/csas-sccs/index-eng.htm.

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